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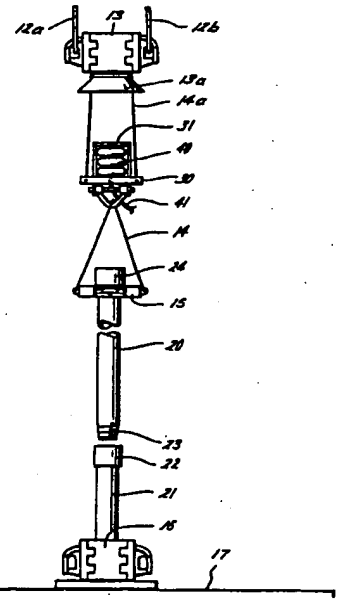
## (54) Device for handling well casings.

(57) A device (1) for use in handling casing (20) in a rotary drilling rig configuration comprises a first member (30) attachable to a lifting block (10), a second member (31) to which the casing (20) can be connected and a bellows (40) which is disposed between the first member (30) and the second member (31) and can be inflated via an air line (41). The casing (20) is positioned directly above the assembled casing string (21).

In operation the bellows (40) is pressurized until the maximum pressure permitted by a relief valve (not shown) is attained. The rig hand may then manually adjust the pressure downward until the preferred pressure is reached. Because of the «lift» provided by the bellows (40), that preferred pressure will be characterized by the seemingly weightless suspension of the casing (20) above the box (22) and the relative ease with which the casing (20) may be manually lowered by the rig hand under the increased control provided by the device, so that the threads of the pin (23) and box (22) may be properly aligned and connected with damage to neither. If the weight of each casing (20) is substantially the same weight as the prior casing, the rig hand may simply adjust the adjustable pressure relief valve to vent at a pressure corresponding to the bellows being nearly fully extended with the load applied.

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# DEVICE FOR FACILITATING THE HANDLING OF A LOAD

The invention relates to a device for facilitating the handling of a load and, more particularly but not exclusively, is concerned with a device for facilitating the handling of casings and similar joints used in drilling. The invention also relates to a drilling rig provided with a device in accordance with the invention and a method of handling a load.

In many drilling applications, and especially in deep high pressure wells, one or more casing strings are set to protect the well bore and/or the formation. Whether the crew members are running surface, intermediate, or production casing, the handling of the heavy individual casings presents special problems.

In particular, considerable skill is needed to lower the new casing into position on the assembled casing string and to make the necessary threaded connection between the pin on the new casing and the box on the top of the assembled casing string. Thus, if the new casing is positioned too high above the box on the assembled string, the threads do not engage. On the other hand, if the pin is lowered too far, the full weight of the new casing may rest on the first thread of the assembled string and thread damage may occur. This may require removal of the damaged casing(s) and costly delays. Even if no thread damage initially occurs as a result of lowering the new casing too far the worker (the "stabber") may have difficulty in manoeuvering the casing to align it so as to make a proper threaded connection. In the event of such a misalignment, cross threading or other thread damage may occur.

The preferred embodiment of the present

invention is directed to a device for facilitating the handling of casings and other tubular drill string members to reduce the above problems. It also has applications in the handling of other heavy materials in non-drilling operations.

According to the present invention there is provided a device for facilitating the handling of a load, which device comprises:

a) a first member attachable to a lifting block;

b) a second member to which said load can be connected; and

c) resilient means which, in use, act between said first member and said second member and which permit said load to move downwardly with respect to said first member when downward pressure is applied to said load.

Preferably, one of said first and second members has an end wall and a side wall having at least two elongate slots therein disposed to opposite sides of said one member, and wherein the other member is provided with a bar which extends through said slots and the ends of which provide attachment points for connecting said other member to said lifting block.

The resilient means may be hydraulic, mechanical or pneumatic.

Thus, for example, the resilient means could comprise a hydraulic piston and cylinder assembly disposed between the first and second members and associated with a control mechanism adapted to admit or vent hydraulic fluid from the assembly to raise or lower the load with respect to the first member. In such an embodiment a hydraulic accumulator or the like is provided to introduce resilience into the system.

Alternatively, the resilient means could comprise a spring which would preferably be adjustable. Whilst this would be quite acceptable for substantially

uniform loads it is not particularly favoured where the load is not constant.

As a further alternative the resilient means may act, in use, between the first member and the second member by compressed gas. The compressed gas may be contained in a piston and cylinder arrangement or in a bellows. In order to accommodate varying loads, means are preferably provided to adjust the gas pressure in the piston and cylinder or bellows either by the admission of gas thereto or by the venting of gas therefrom. Thus, the gas pressure may be set so that the load is exactly supported by the bellows or the piston and cylinder in an expanded state. Downward pressure on the load will result in the bellows or piston and cylinder contracting and the load moving downwards. This can, of course, greatly facilitate the connection of a new casing to an assembled pipe string since the weight of the new casing is counterbalanced by the gas pressure.

A pressure relief valve may be provided which may be set to vent either at the maximum design pressure of the equipment or, at a given pressure corresponding to the load being balanced. This would normally be the case where successive loads are substantially equal.

If desired, means may be provided to automatically adjust the pressure in the piston and cylinder or bellows to maintain the first and second members spaced apart by a given distance when the load is first lifted. Once the load is near its final position the automatic means are rendered inoperative to enable the load to be lowered by the application of downward pressure.

The present invention also provides a method of handling a load, which method comprises the steps of:

a) mounting a first member on a lifting block;

b) connecting a load to a second member;

c) applying a resilient force between said first and second members to maintain said first and second members apart; and

d) applying downward pressure to said load to lower said load with respect to said first member.

The resilient force which maintains the first and second members apart is preferably applied by gas pressure.

For a better understanding of the invention reference will now be made, by way of example, to the accompanying drawings, in which:-

Figure 1 is a perspective view of a portion of a typical rotary drilling rig configuration provided with one embodiment of a device in accordance with the present invention connected to a single joint elevator in preparation for lifting a casing into the mast;

Figure 2 is a perspective view showing the casing being lifted into the mast;

Figure 3 is a perspective view showing the casing suspended over the assembled casing string;

Figure 4 is a perspective view showing the casing attached to the assembled casing string;

Figure 5 is a perspective, partly sectioned view of the device shown in Figure 1;

Figure 6 is a sectional view taken along line 6-6 of Figure 5; and

Figure 7 is a partly sectional view taken along line 7-7 of Figure 6.

Figures 1-4 generally depict a rotary drilling rig configuration in the process of connecting a new casing 20 to an assembled casing string 21.

When casing is being "run", or connected in an assembled string and lowered into a hole that has already been drilled, the rig is typically configured to handle the very heavy weight of the assembled casing string 21 by suspending the travelling block 10 from the crown block (not shown) using multiple wraps of the drilling line 11 around the sheaves of the travelling block 10. On heavy strings, a large number of wraps, up to sixteen or more, may be required. From bails 12a and 12b on the travelling block is suspended an elevator 13, normally a slip elevator, sized to hoist and lower the entire weight

of the assembled casing string, which weight may exceed 2,000,000 pounds (900 tonnes).

Below the primary elevator 13 is normally suspended by cables and a swivel (not illustrated), a smaller elevator often called the single joint elevator so named because it is sized to hoist and lower a single casing 20. The single joint elevator 15 is typically required to hoist and lower only approximately 100 to 20,000 pounds weight (45 to 9090 kg).

That portion of the assembled casing string 21 which has already been assembled and lowered into the hole is suspended in a spider 16 mounted on the rig floor 17. The slips of the spider 16 grasp the uppermost member of the assembled casing string 21 below its box 22 (or female threaded end), leaving the box 22 exposed for connection with the pin 33 (or male threaded end) of the next casing 20 to be added to the assembled casing string.

As illustrated in Figures 1 and 2, the single joint elevator 15 is displaced to the area of the next casing 20 to be added and attached thereto just below its box 24. By operating the drawworks (not shown), the driller draws up some of the drilling line 11 so as to hoist into the mast the single joint elevator 15 and casing 20. Hoisting continues until the casing 20 is positioned vertically above the spider 16 and the exposed box 22, as depicted in Figure 3. This process requires the driller to then lower the casing length 20 so that the "stabber" can stab the pin 23 into the box 22 and rotate it to "make-up" the connection. Rotation and make-up is typically accomplished via use of power tongs 18, shown in Figure 4. Then the single joint elevator 15 is disengaged on the casing 20. The slips of the spider 16 are released, and the assembled casing string 21 is lowered into the well bore the length of the casing 20.

At this point, the spider slips 16 are reset and the entire process is repeated until all of the casing lengths have been made-up.

Heretofore, making the connection between the pin 23 and the box 22 has required considerable skill as discussed hereinbefore. However, the degree of skill required is considerably reduced by the provision of device 1 which is positioned between the primary elevator 13 and the single joint elevator 15. In particular the device 1 is suspended by cable 14a from the bell 13a of primary elevator 13 and has suspended below it a cable 14 to which the single joint elevator 15 is attached.

Referring to Figures 5 to 7, the device comprises a lower housing member 30 and an upper housing member 31.

The upper housing member 31 has an end well 31a and a substantially vertical and cylindrical side wall 31b extending therebelow. The side wall 31b is provided with one or more elongate slots 31c.

The lower housing member 30 comprises bars 30a and 30b which extend through the elongate slots 31c. The cable 14a is attached to bolts extending between the bars 30a and 30b adjacent the ends thereof.

Attached to and positioned between the lower housing member 30 and the underside of the end wall 31a of upper housing member 31 is a bellows 40. The bellows 40 may consist of commercially available air springs or air actuators. Upon inflating the bellows 40 (as via an air supply (not shown) connected to air line 41), the upper housing member 31 is lifted upward and away from lower housing member 30 by the expansion of the bellows 40, as illustrated in Figure 3. When deflated, the bellows 40 contracts, causing the upper housing member 31 to lower, as illustrated in Figure 4. This expansion and contraction permits the vertical position of the

suspended casing 20 to be altered relative to the lower casing member 30 by manually pulling downward on the suspended casing 20 until the pin 23 is properly positioned. Rotation is permitted by a swivel (not shown) mounted between the primary elevator 13 and the single joint elevator 15.

A conventional pneumatic supply provides a source of air for the bellows 40. Manually operable means (not shown) are provided to apply the bleed off air from within the bellows 40. An adjustable pressure relief valve is also provided, the venting pressure of which is determined by the characteristics of the particular bellows employed and the desired handling characteristics described below.

In operation, a single casing 20 is hoisted into the mast. The bellows 40 is pressurized until the maximum pressure permitted by the relief valve (not shown) is attained. The rig hand may then manually adjust the pressure downward until the preferred pressure is reached. Because of the "lift" provided by the bellows 40, that preferred pressure will be characterized by the seemingly weightless suspension of the casing 20 above the box 22 and the relative ease with which the casing 20 may be manually lowered by the rig hand under the increased control provided by the device, so that the threads of the pin 23 and box 22 may be properly aligned and connected with damage to neither. If the weight of each casing 20 is substantially the same weight as the prior casing, the rig hand may simply adjust the adjustable pressure relief valve to vent at a pressure corresponding to the bellows being nearly fully extended with the load applied.

Various modifications to the embodiment described with reference to the drawings are envisaged, for example means may be provided to automatically adjust

the pressure in the bellows 40 according to the load. Such means could operate for example by admitting air to the bellows until the upper member 31 and the lower member 30 are spaced apart by a given distance. It would, of course, be necessary to render such automatic means inoperative to enable the casing to be offered up to the assembled casing string.

Further, although the presently preferred embodiment incorporates bellows, to the extent that other embodiments incorporate mechanical springs and penumatic or hydraulic cylinders for the same purpose, in the same way, and to accomplish the same result, they are also encompassed within the scope of this invention. When used in this invention, such mechanical springs may be adjustable or non-adjustable. And, when used in this invention, the parts of the pneumatic or hydraulic cylinder may themselves form the upper and lower members of the device.

If desired, the device may be incorporated in a swivel and/or in an elevator.

If desired , the device may comprise a substantially enclosed first member having a top wall and a bottom wall attached by a side wall. A bellows is mounted in the first member and acts between the bottom wall of the first member and the top wall of a member which extends across the interior of the first member and is connected to lifting straps which extend downwardly from the top member through openings in the bottom wall of the first member.

A stop may be provided to limit downward movement of the top wall and thereby prevent the bellows being crushed.

## CLAIMS

1. A device for facilitating the handling of a load, which device comprises:

a) a first member (30) attachable to a lifting block (10);

b) a second member (31) to which said load (20) can be connected; and

c) resilient means (40) which, in use, act between said first member (30) and said second member (31) and which permit said load (20) to move downwardly with respect to said first member (30) when downward pressure is applied to said load (20).

2. A device according to Claim 1, wherein one (31) of said first and second members (30,31) has an end wall (31a) and a side wall (31b) having at least two elongate slots (31c) therein disposed to opposite sides of said one member (31), and wherein the other member (30) is provided with a bar (30a) which extends through said slots (31c) and the ends of which provide attachment points for connecting said other member (30) to said lifting block (10).

3. A device according to Claim 1, wherein said first member comprises an enclosure having a top wall, a bottom wall and a side wall extending therebetween, wherein said second member comprises a top wall mounted in said first member and provided with lifting straps which extend through the bottom wall of said first member, and wherein said resilient means acts between the bottom wall of said first member and the top wall of said second member.

4. A device according to Claim 3, including a stop arranged to limit the minimum distance between said first and second members.

5. A device according to Claim 1,2,3 or 4, wherein said resilient means (40) comprises a spring.

6. A device according to Claim 5, including means to adjust the stiffness of said spring.

7. A device according to Claim 1,2,3 or 4, wherein said resilient means (40) is hydraulically actuable.

8. A device according to any one of Claims 1 to 6, wherein said resilient means acts, in use, between said first member (30) and said second member (31) by compressed gas.

9. A device according to Claim 8, including an adjustable pressure relief valve.

10. A device according to Claim 8 or 9, including means to adjust the pressure in said resilient means (40) to a desired setting.

11. A device according to Claim 10, including means to automatically adjust the pressure in said resilient means (40) to maintain said first member (30) and said second member (31) spaced apart by a given distance when said load (20) is lifted, said means being capable of being rendered inoperative to allow manual downward pressure on said load to displace said load (20) downwardly with respect to said first member (30).

12. A device according to any one of Claims 8 to 11, wherein said resilient means (40) comprises a bellows (40).

13. A device according to any one of Claims 8 to 11 wherein said resilient means (40) comprises a piston and cylinder.

14. A device according to any preceding Claim, wherein a joint elevator (15) is connected to said second member (31).

15. A drilling rig provided with a device as claimed in any preceding Claim.

16. A method of handling a load, which method

comprises the steps of:

a) mounting a first member (30) in a lifting block (10);

b) connecting a load (20) to a second member (31);

c) applying a resilient force between said first and second members (30, 20) to maintain said first and second members (30,31) apart; and

d) applying downward pressure to said load (20) to lower said load (20) with respect to said first member (30).

17. A method according to Claim 16, wherein said resilient force which maintains said first and second members (30, 31) apart is applied by gas pressure.

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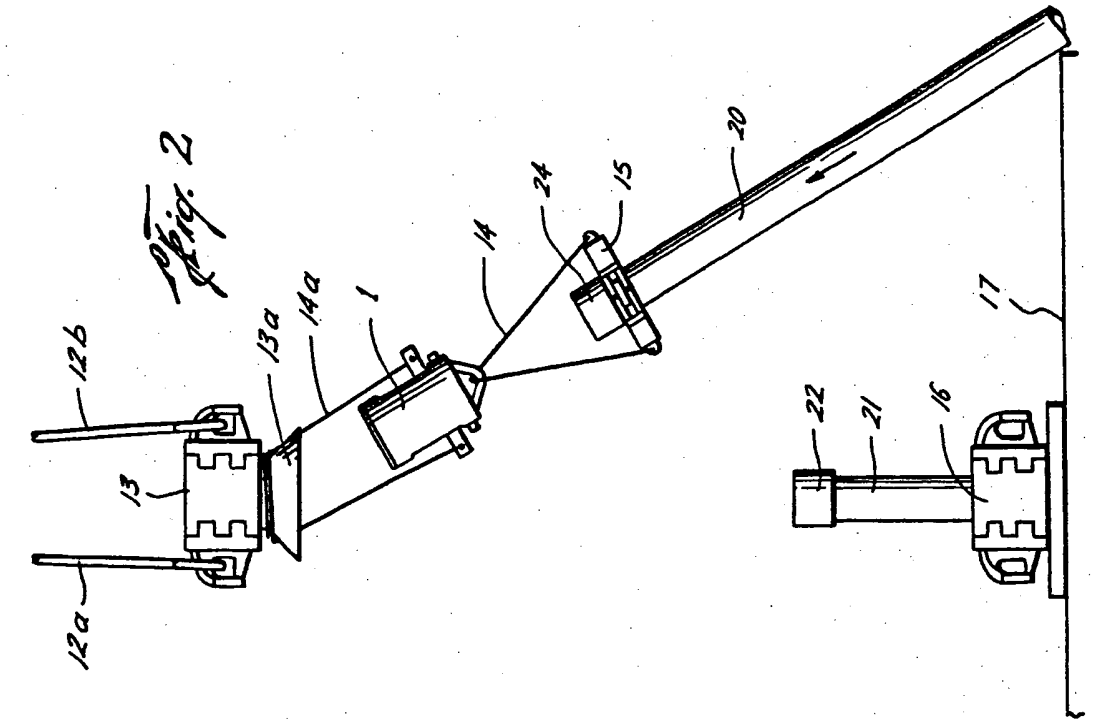


Fig. 2

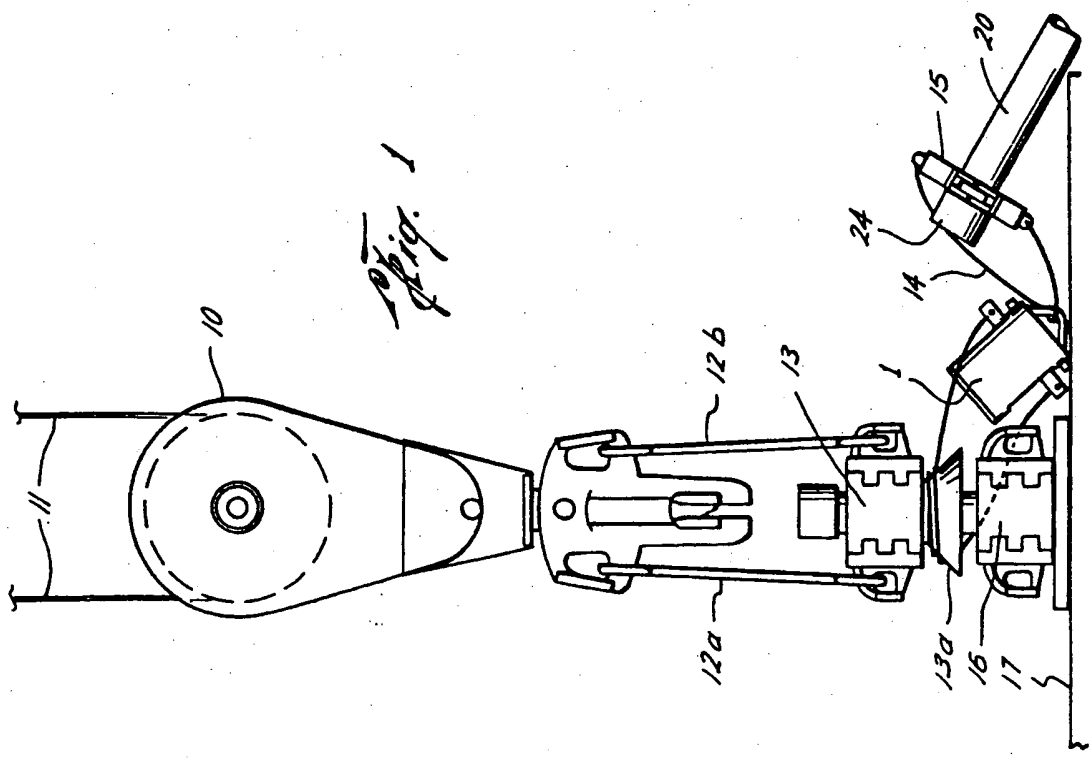


Fig. 1

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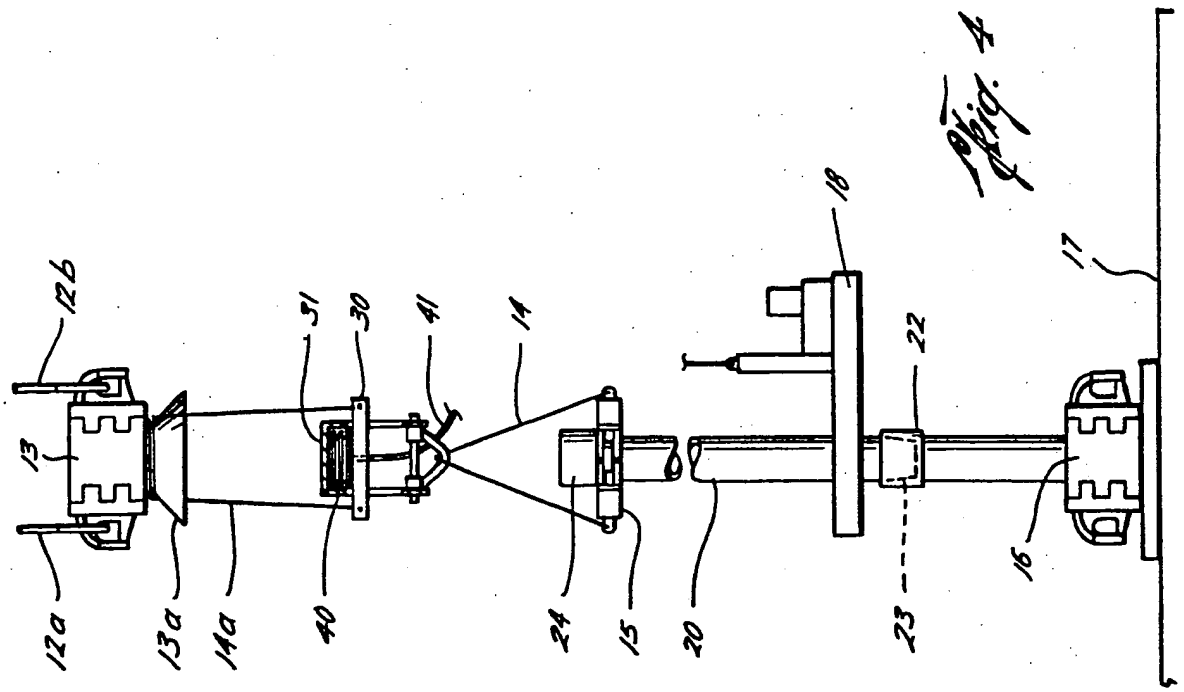


Fig. 4

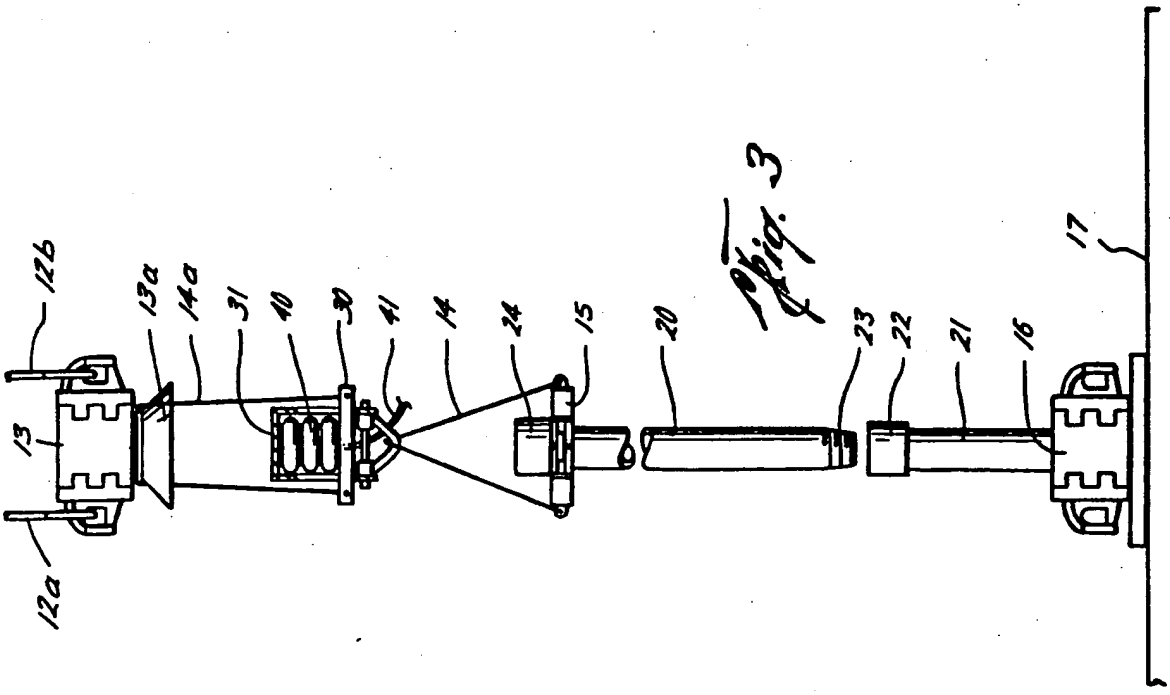


Fig. 3

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Fig. 5

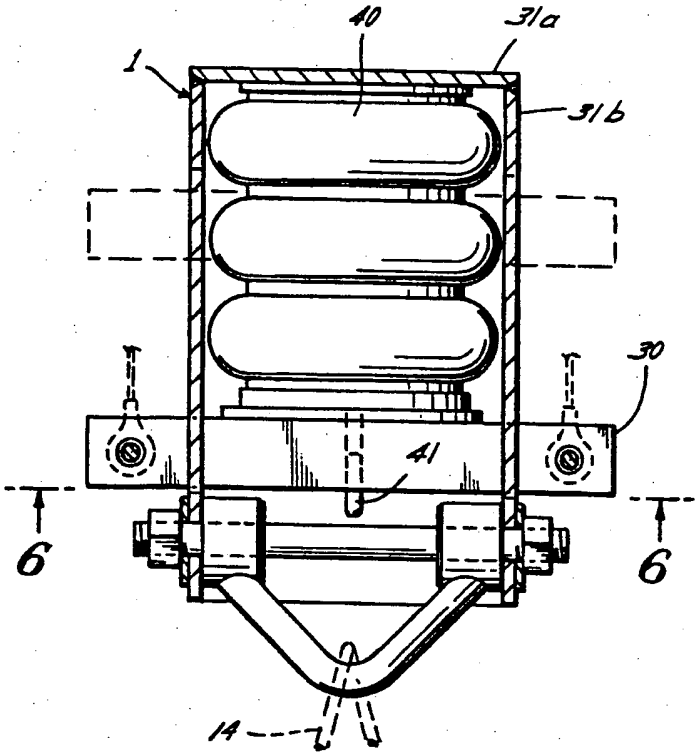



Fig. 7

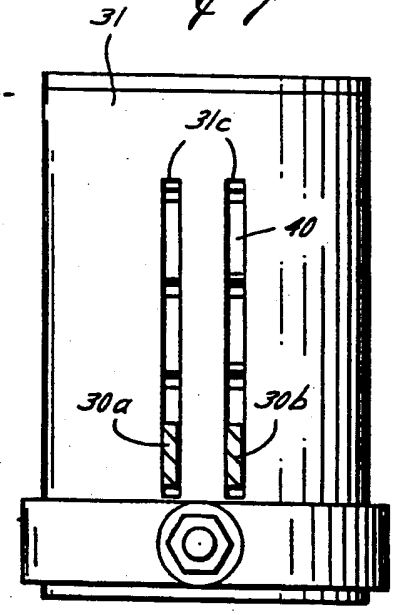
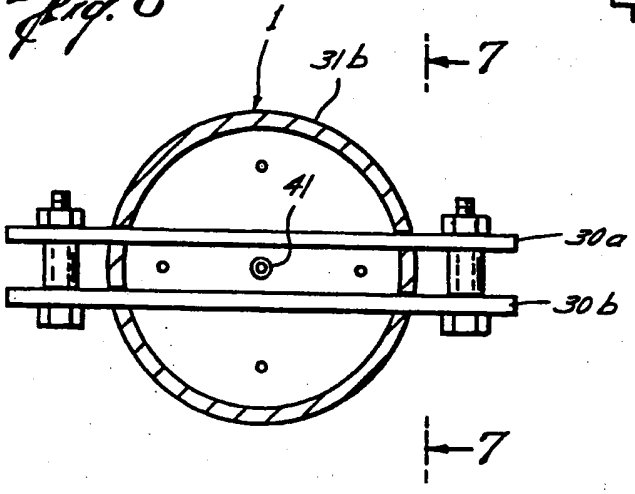



Fig. 6



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# EUROPEAN SEARCH REPORT

0171144
Application number

EP 85 30 4072

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int. Cl.4) |
|---|---|---|---|
| Y | US-A-1 454 194 (THOMAS)<br>* The whole document * | 1-17 | E 21 B 19/06<br>E 21 B 19/15<br>B 66 C 13/04 |
| Y | FR-A-1 145 717 (PELLAT-FINET)<br>* The whole document * | 1-17 | |
| A | US-A-1 842 638 (WIGLE)<br>* The whole document * | 1,15, 16 | |
| A | US-A-2 622 916 (LIBIN et al.)<br>* The whole document * | 1,15, 16 | |
| A | US-A-3 351 372 (MARKS et al.)<br>* The whole document * | 1,15, 16 | TECHNICAL FIELDS SEARCHED (Int. Cl.4) |
| A | FR-A-1 497 666 (MOIOLI) | | B 66 C<br>B 66 F<br>E 03 F<br>E 21 B |
| A | WO-A-8 101 402 (McCALLUM et al.) | | |

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| THE HAGUE | 02-10-1985 | BENZE W.E. |

CATEGORY OF CITED DOCUMENTS

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